Hello! Thanks for helping to look at this, provide thoughts and insights, etc. - it's very appreciated.

It's important that your edits are easily found. So, with that in mind, please do all edits using Track Changes.

To use track changes in Excel, click on the "review" tab. Under Review, click "Track Changes" (located in the right-most a

Then click on "Highlight Changes". This should open a box with various options.

Check the box at the top, to track changes while editing.

Then make sure that the box next to "when" is checked, and the text says "all".

Make sure the box is checked next to "highlight changes on screen".

Project Stage	General Topic	Specific Metric(s)	Analysis Already Agreed To By USAF?
Pre-Baseline			
	Monitoring Well Installations		
		Continuous logging	Y
		PID readings	Y
		LNAPL Dye Test; VOC and TPH if Dye Test is Positive	Y
		VOCs	Y
		TPH (DRO, GRO)	Y
Baseline Data			

Timing of Analyses	Frequency of Analyses	Location of Analyses
Before baseline geochemistry, field data, and microbial analyses performed	(Once - is an installation)	(Location of Installations)
	Once	CZ
	Once	UWBZ
	Once	LSZ
During EBR, following Table 5.1	During EBR, following Table 5.1	Following Table 5.1
During EBR, following Table 5.1	During EBR, following Table 5.1	Following Table 5.1
During EBR, following Table 5.1	During EBR, following Table 5.1	Following Table 5.1
During EBR, following Table 5.1	During EBR, following Table 5.1	Following Table 5.1
During EBR, following Table 5.1	During EBR, following Table 5.1	Following Table 5.1

Purpose
These are additional wells to provide accurate monitoring of EBR
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. The extraction wells can be used, but must be considered in separate groups and are not sufficient for this evaluation.
To determine if benzene is slower to degrade than other aromatics (or faster, or average)
To provide one singular, synoptic round of data prior to inception of EBR

Additional Comments
MWs are needed in suitable locations to monitor the effectiveness of EBR. Otherwise, data evaluation will be much less meaningful. Accurate delineation of concentrations in downgradient portions of the site should also be emphasized relative to off-site migration potential, sulfate utilization, etc. To the degree possible, wells should also be located so that aquifer heterogeneities (low-permeability zones) can be monitored and accurate spatial averages for parameter values can be computed. New MWs must have time to equilibrate after installation and development before baseline field data, geochemistry, and microbial analyses are performed.
7 treatment "ovals" proposed, but only 3 ovals have monitoring wells that are in reasonable locations (5/17 BCT slides) **Karla: what was the reference for this? What is the source of the diagrams you are referencing?**
5 initial treatment "ovals" proposed; however, only one of the first 5 "ovals" where EBR is proposed for initial implementation has a monitoring well (ST012-UWBZ24), but it is not located in an optimal location for monitoring the effectiveness of treatment (i.e., it Is not located on the path between the injection and extraction wells); 5 additional treatment "ovals," but there are no monitoring wells in these ovals (5/17 BCT slides) **Karla: what was the reference for this? What is the source of the diagrams you are referencing?**
15 treatment "ovals" proposed, but only 2 have monitoring wells in suitable locations. 3 additional "ovals" have monitoring wells located beyond the extraction well. Depending on how the extraction wells are pumped, sulfate may never reach these monitoring wells (5/17 BCT slides) **Karla: what was the reference for this? What is the source of the diagrams you are referencing?**
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
These data, collectively, will help establish baseline criteria against which project progress and goals can be compared and monitored.

Hydrogeologic Data

Groundwater gauge data (depth to water, depth to product, product thickness)	
Perform Slug Tests	
Biofouling	Y

Mapping Contaminant Locations and Concentrations

Continue to locate and map LNAPL presence and depth	Y
Monitor benzene content and concentration in LNAPL, where LNAPL is found	Y
Continue to locate and map dissolved-phase benzene presence and concentration	Y
Continue to locate and map dissolved-phase SVOC presence and concentration **Do we need to re-phrase??**	
Calculate total LNAPL mass present at start of EBR	Y
Determine the content of COCs in the LNAPL at the start of EBR	
Locate and map sulfate concentrations	Y

Modeling

After SEE but before EBR injections or amendments	Once as baseline	New and existing MWs, located in the area to be impacted by injections/ amendments, and downgradient of this area
		All New Wells and Existing Wells that have not been tested
After SEE but before EBR injections or amendments	Once as baseline	New and existing MWs, located in the area to be impacted by injections/ amendments, and downgradient of this area
	Monthly	Perimeter wells
		New and existing MWs with recoverable LNAPL
After SEE but before EBR injections or amendments	Once as baseline	Targeted treatment area and downgradient portions of the site

Hydraulic Conductivity Measurement
Comparison of NAPL compositions before/during EBR to assess reductions in COC content
When compared to this baseline data, this information will help monitor for sulfate migration outside of the COC areas and facilitate comparison of EBR modeling results with field data

Data should be aquired for all three zones, including CZ
Data should be aquired for all three zones, including CZ
See modeling comments by Bo Stewart, 5/17
Need to ensure good knowledge of locations where EBR treatments/amendments are being conducted, as well as downgradient
Report (graph) dissolved-phase trends over time, in addition to LNAPL trends for perimeter wells
Done. ADEQ transmitted extensive comments on the most recent AF mass and composition estimates of remaining NAPL on May 16.
The existing characterization of NAPL composition is dated and displays a large deviation in a relatively small set of analyses. The most recent samples were collected from a NAPL holding tank. This NAPL was the combined recovery from the CZ, UWBZ and LSZ with unknown fractions from each. To allow a meaningful comparison of NAPL compositions before/during EBR to assess reductions in COC content, large set of NAPL should be collected and analyzed separately from each zone and across each zone.

Provide a time estimate for sufficient LNAPL depletion of COCs	
Provide details of EBR modeling to calculate time estimates for remediation	
Provide proof of concept supporting the sulfate reduction for EBR	
Provide details used to determine the optimal sulfate injection strategy.	

GW Geochemistry

Temperature	Y
pH	Y
ORP value	Y
Dissolved Oxygen	Y
Nitrate	Y
Ferrous Iron	
Total Iron	
Sulfate	Y
Hydrogen Sulfide	
Methane	
Alkalinity	
TPH (DRO, GRO)	Y
VOCs	Y
Arsenic	Y

Indigenous Microbial Population

Total size	

After SEE but before EBR injections or amendments	Once as baseline	New and existing MWs, located in the area to be impacted by injections/ amendments, and downgradient of this area
After SEE but before EBR injections or amendments	Once to establish baseline	Samplers should be placed so as to monitor the core of sulfate injections, its periphery, and downgradient. All three zones should be monitored. The same wells should be monitored pre-EBR, during EBR, and post-EBR.

These analyses will quantify the size, makeup, and health of the indigenous microbial community.

EBR modeling by the AF ignored rate-limited mass transfer of hydrocarbons from the LNAPL to groundwater (AF modeling assumes equilibrium conditions between LNAPL and groundwater, which means unlimited mass transfer from the LNAPL). This mechanism is is very important and can significantly extend remediation time frames.The Regulatory Agencies technical team has performed volume-averaged EBR modeling that confirms the importance of rate-limited LNAPL dissolution (sent to AF under separate cover).
Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results. The Regulatory Agencies technical team has sent a list of these deficiencies to AF.
In particular, very little field data exists for the CZ and the UWBZ. The AF has not performed the EBR pilot test in the UWBZ that was agreed to in the ST012 Work Plan.
Reported on AF flowchart as Eh
AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
All items other than the last metric are included as part of the already-proposed standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision flowchart, but are not included in the metrics to be reported. All of these data are key to fully understanding the makeup, activities, and health of the indigenous microbial population. These samplers cannot be used in LNAPL, but can be deployed underneath LNAPL.

Major groups within population, and their proportion of total	
Total size of sulfate-reducing bacteria	Y(?)
Total size of benzene-degrading bacteria	
In-situ benzene degradation rate	
Amount of benzene converted to biomass during stable isotope study	Y
Amount of benzene converted to carbon dioxide during stable isotope study	Y
The overall health of the indigenous microbial population, as determined via PLFA analyses	
The dominant electron-accepting process for indigenous microbial population, and reason for the conclusion	

Assessments During EBR

Hydrogeologic Data

Groundwater gauge data (depth to water, depth to product, product thickness)	
Biofouling	Y

Mapping Contaminant Locations and Concentrations

Locate and map LNAPL presence and depth - monitoring wells	y
Locate and map dissolved-phase benzene presence and concentration	y
Locate and map dissolved-phase TPH presence and concentration	y
Calculate total LNAPL mass	

		New and existing MWs, located in the area to be impacted by injections/ amendments, and downgradient of this area
	quarterly	
	annual??	
During EBR		New and existing MWs, located in the area to be impacted by injections/ amendments, and downgradient of this area
	Sampling and analysis following schedule outlined in Table 4.1 of referenced document; mapping performed once per month	
	Quarterly	

These assessments will be used to monitor the progress of EBR, and to determine if changes to the EBR strategy need to be made. These will also help monitor progress of EBR.

AF decision flowchart references SRB gene, but Microbial Insights uses the APS gene to screen for sulfate reducers. Unclear as to what "SRB" gene is being referenced in flowchart.
Need to ensure good knowledge of locations where EBR treatments/amendments are being conducted, as well as downgradient. Final Field Variance Memorandum #5 – Extraction and Treatment System Construction, Former Liquid Fuels Storage Area, Site ST012, Former Williams Air Force Base, Mesa, Arizona; 01 Dec 2016

Modeling

Determine the content of COCs in the LNAPL	
Locate and map sulfate concentrations in the targeted treatment area as well as downgradient	Y
Provide a time estimate for **sufficient** LNAPL depletion of COCs	
Provide details of EBR modeling to calculate time estimates for remediation	
Provide proof of concept supporting the sulfate reduction for EBR	
Provide details used to determine the optimal sulfate injection strategy.	

GW Geochemistry

Temperature	Y
pH	Y
ORP value	Y
Dissolved Oxygen	Y
Nitrate	Y
Phosphorous	
Ferrous Iron	
Total Iron	
Sulfate	Y
Hydrogen Sulfide	
Methane	
Alkalinity	
TPH (DRO, GRO)	Y
VOCs	Y
Arsenic	Y

	Quarterly	MWs with recoverable NAPL located in the area to be impacted by injections/ amendments
During EBR	At least annual	
During EBR	Monthly for the first quarter of EBR, followed by quarterly	New and existing MWs

Comparison of NAPL compositions before/during EBR to assess reductions in COC content
To help monitor key microbial nutrient availability
Will help determine preferer TEA for indigenous microbes
Will help determine preferer TEA for indigenous microbes
To monitor if periodic sulfate injections or recirculation be necessary to sustain degradation rates
To monitor if hydrogen sulfide concentrations inhibit degradation or will subsurface conditions mitigate their buildup?

when compared to this baseline data, this information will help monitor for sulfate migration outside of the COC areas
Ongoing updates as field data become available. EBR modeling by the AF ignored rate-limited mass transfer of hydrocarbons from the LNAPL to groundwater (AF modeling assumes equilibrium conditions between LNAPL and groundwater, which means unlimited mass transfer from the LNAPL). This mechanism is is very important and can significantly extend remediation time frames.The Regulatory Agencies technical team has performed volume-averaged EBR modeling that confirms the importance of rate-limited LNAPL dissolution (sent to AF under separate cover).
Ongoing updates as field data become available. Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results. The Regulatory Agencies technical team has sent a list of these deficiencies to AF.
Ongoing updates as field data become available
Ongoing updates as field data become available
These analyses will provide an indirect method of monitoring the indigenous microbial community.
Reported on AF flowchart as Eh
AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored

TEA Injection Fluid

ICP Metals	Y
Details of injection material composition	
Sulfate	Y
Location of each injection/amendment	
Concentration of sulfate at each injection/ amendment location	
Anticipated zone of influence for each injection/ amendment	
When sulfate is no longer limiting rates of degradation, what will limit the reaction and what degradation rates can be expected?	

Indigenous Microbial Population

Total size	
Major groups within population, and their proportion of total	
Total size of sulfate-reducing bacteria	Y (?)
Total size of benzene-degrading bacteria	
In-situ benzene degradation rate	
Amount of benzene converted to biomass during stable isotope study	Y
Amount of benzene converted to carbon dioxide during stable isotope study	Y
The overall health of the indigenous microbial population, as determined via PLFA analyses	

During EBR, for every injection/ amendment event and location		
	Monthly, per Table 5.1 Need to check each batch	
During EBR, 6-9 months post-injection (per Decision Matrix)	At least once during EBR, 4-6 weeks after initial sulfate injection. May need to be repeated if geochem data suggests a problem.	Samplers should be placed so as to monitor the core of sulfate injections, its periphery, and downgradient. All three zones should be monitored. The same wells should be monitored pre-EBR, during EBR, and post-EBR.

To record makeup and concentration of injection fluid
Will the injected sulfate become well distributed with respect to NAPL accumulations?
These analyses will quantify the size, makeup, and health of the indigenous microbial community. If there are indications that the microbial population is struggling during EBR, the analyses should be repeated to determine if alternate strategies are needed
May also help determine lag time for SRBs to acclimate to elevated sulfate concentrations and determine if highly concentrated injections of sulfate will be inhibitive to bacterial activity

Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016); This data will provide a record of exactly what was injected, where, and at what concentration. This, when compared with the response by the contaminants and other geochemical and biological data, will help determine if any changes need to be made to amendment variables such as frequency, concentration, etc.
This may be proprietary, however, an effort to obtain this information should be made
Need to check the injection fluid before goes into ground to ensure concentration is as expected , was mixed and diluted correctly, etc.
All items other than the last metric are included as part of the already-proposed, standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision flowchart, but are not included in the metrics to be reported. All of these data are key to fully understanding the makeup, activities, and health of the indigenous microbial population. These samplers cannot be used in LNAPL, but can be deployed underneath LNAPL.
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016). AF decision flowchart references SRB gene, but Microbial Insights uses the APS gene to screen for sulfate reducers. Unclear as to what "SRB" gene is being referenced in flowchart.

The dominant electron-accepting process for indigenous microbial population, and reason for the conclusion	

Post-EBR Data

Hydrogeologic Data

Groundwater gauge data (depth to water, depth to product, product thickness)	
Biofouling	Y

Mapping Contaminant Locations and Concentrations

Locate and map LNAPL presence and depth	
Locate and map dissolved-phase benzene presence and concentration, in excess of 5 ug/L	
Locate and map dissolved-phase TPH presence and concentration	
Calculate total LNAPL mass present at conclusion of EBR	
Determine the content of COCs in the LNAPL at the conclusion of EBR	
Locate and map sulfate concentrations in the targeted treatment area as well as downgradient	Y

Modeling

Post-EBR	Quarterly, until the official start of the MNA phase of the site (??) [What is the "official start of MNA"? Do you need data this often?]	Each MW used for injections, amendments, or any analyses
Post-EBR		Each MW used for injections, amendments, or any analyses
[Same comments as above] ???		
Post-EBR		

This data will be compared against baseline data, and data taken during EBR, to determine the success of the project as well as to identify necessary future actions. This data will also become the baseline information used at the start of MNA

Update based on additional field data
At the end of EBR, LNAPL should be sampled throughout the Site (not just from LNAPL in monitoring wells) to determine if LNAPL throughout the Site, including in low permeability/low flow zones), is depleted of COCs to the extent necessary to keep GW COC concentrations below RAOs. This LNAPL sampling will require boreholes.
when compared to this baseline data, this information will help monitor for sulfate migration outside of the COC areas
Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in email dated 5/11)? benzene mole-fraction/concentration changes with time in the LNAPL ? [Refer to our comments throughout on this questions]

Provide a time estimate for sufficient LNAPL depletion of COCs by MNA	
Provide details of post-EBR modeling to calculate time estimates for remediation	

GW Geochemistry

Temperature	Y
pH	Y
ORP value	Y
Dissolved Oxygen	Y
Nitrate	Y
Ferrous Iron	
Total Iron	
Sulfate	Y
Hydrogen Sulfide	
Methane	
Alkalinity	
TPH (DRO, GRO)	Y
VOCs	Y
Arsenic	Y

Indigenous Microbial Population

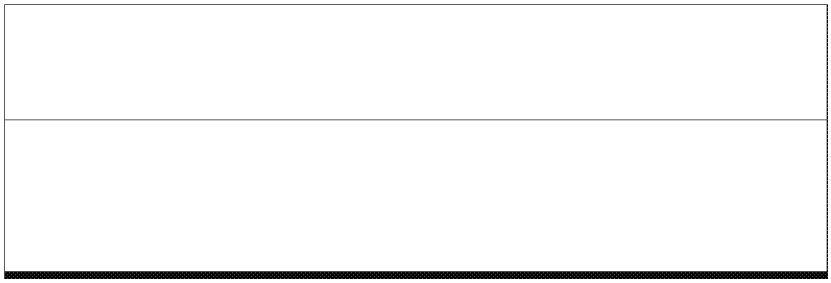
Total size	
Major groups within population, and their proportion of total	
Total size of sulfate-reducing bacteria	
Total size of benzene-degrading bacteria	Y (?)
In-situ benzene degradation rate	
Amount of benzene converted to biomass during stable isotope study	Y
Amount of benzene converted to carbon dioxide during stable isotope study	Y

Post-EBR		Each MW used for injections, amendments, or any analyses
Post-EBR	Once, within 3 months of the last injection/ amendment	Samplers should be placed so as to monitor the core of sulfate injections, its periphery, and downgradient. All three zones should be monitored. The same wells should be monitored pre-EBR, during EBR, and post-EBR.

These analyses will quantify the size, makeup, and health of the indigenous microbial community at the end of EBR, and will provide baseline data for MNA

Reported on AF flowchart as Eh
AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
All items other than the last metric are included as part of the already-proposed standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision flowchart, but are not included in the metrics to be reported. All of these data are key to fully understanding the makeup, activities, and health of the indigenous microbial population. These samplers cannot be used in LNAPL, but can be deployed underneath LNAPL.
AF decision flowchart references SRB gene, but Microbial Insights uses the APS gene to screen for sulfate reducers. Unclear as to what "SRB" gene is being referenced in flowchart.

	The overall health of the indigenous microbial population, as determined via PLFA analyses	
	The dominant electron-accepting process for indigenous microbial population, and reason for the conclusion	



Action Number	Date	Time	Who	Change	Sheet
1	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
2	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
3	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
4	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
5	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
6	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
7	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
8	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
9	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
10	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
11	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
12	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
13	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
14	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
15	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
16	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
17	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
18	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
19	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
20	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
21	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
22	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
23	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
24	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
25	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
26	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
27	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
28	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
29	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
30	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
31	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
32	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle

Range
I23
G23
H23
I22
C26
C27
I27
C29
C28
I28
C23
C64
F63
F64
I63
I64
H64
G64
I67
F66
C67
C68
C69
C70
I68
I70
I69
#REF!
C113
I113
C114
C63

New Value
The existing characterization of NAPL composition is dated and displays a large deviation in a relatively small set of analyses. The most recent samples were colle
New and existing MWs with recoverable NAPL, located in the area to be impacted by injections/ amendments, and downgradient of this area
Comparison of NAPL compositions before/during EBR to assess reductions in COC content
ADEQ transmitted extensive comments on the most recent AF mass and composition estimates of remaining NAPL on May 16.
Provide a time estimate for sufficient LNAPL depletion of COCs
Provide details of EBR modeling to calculate time estimates for remediation
Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results
Provide details used to determine the optimal sulfate injection strategy.
Provide proof of concept supporting the sulfate reduction for EBR
In particular, very little field data exists for the CZ and the UWBZ. The AF has not performed the EBR pilot test in the UWBZ that was agreed to in the ST012 Work
Determine the content of COCs in the LNAPL at the start of EBR
Determine the content of COCs in the LNAPL
Quarterly
Quarterly
Update based on additional field data
Update based on additional field data
Comparison of NAPL compositions before/during EBR to assess reductions in COC content
MWs with recoverable NAPL located in the area to be impacted by injections/ amendments
Ongoing updates as field data become available
Quarterly
Provide a time estimate for sufficient LNAPL depletion of COCs
Provide details of EBR modeling to calculate time estimates for remediation
Provide proof of concept supporting the sulfate reduction for EBR
Provide details used to determine the optimal sulfate injection strategy.
Ongoing updates as field data become available
Ongoing updates as field data become available
Ongoing updates as field data become available
<blank>
Calculate total LNAPL mass present at conclusion of EBR
Update based on additional field data
Determine the content of COCs in the LNAPL at the conclusion of EBR
Calculate total LNAPL mass

Old Value
<blank>
<blank>
<blank>
<blank>
Determine the time estimate for LNAPL removal
Provide details of how pre-EBR LNAPL models were generated
<blank>
Provide details used to determine the sulfate calculations
Calculate the amount of sulfate needed to maximize benzene biodegradation
<blank>
Determine the amount of benzene in the LNAPL at the start of EBR
Determine the amount of benzene in the LNAPL
Monthly
Monthly
<blank>
<blank>
<blank>
<blank>
<blank>
Quarterly (?)
Determine the time estimate for LNAPL removal
Provide details of how pre-EBR LNAPL models were generated
Calculate the optimal amount of sulfate needed to maximize benzene biodegradation
Provide details used to determine the sulfate calculations
<blank>
<blank>
<blank>
Assess depletion of aromatic compounds from NAPL
Calculate total LNAPL mass is present at conclusion of EBR
<blank>
Determine the amount of benzene in the LNAPL at the conclusion of EBR
Calculate total LNAPL mass is present

Action Type	Losing Action

	33	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
	34	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
	35	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
	36	5/24/2017	4:11 PM	Bo Stewart	Cell Change	Entire Lifecycle
	37	5/25/2017	10:23 AM	Windows User	Cell Change	Entire Lifecycle
	38	5/25/2017	10:23 AM	Windows User	Cell Change	Entire Lifecycle
	39	5/25/2017	10:54 AM	Windows User	Cell Change	Entire Lifecycle
	40	5/25/2017	10:54 AM	Windows User	Cell Change	Entire Lifecycle
	41	5/25/2017	10:54 AM	Windows User	Cell Change	Entire Lifecycle
	42	5/25/2017	10:54 AM	Windows User	Cell Change	Entire Lifecycle
	43	5/25/2017	10:54 AM	Windows User	Cell Change	Entire Lifecycle
	44	5/25/2017	10:54 AM	Windows User	Cell Change	Entire Lifecycle
	45	5/25/2017	11:00 AM	Windows User	Cell Change	Entire Lifecycle
	46	5/25/2017	11:11 AM	Windows User	Cell Change	Entire Lifecycle
	47	5/25/2017	11:15 AM	Windows User	Cell Change	Entire Lifecycle
	48	5/25/2017	1:04 PM	Windows User	Cell Change	Entire Lifecycle
	49	5/25/2017	1:04 PM	Windows User	Cell Change	Entire Lifecycle
	50	5/25/2017	1:14 PM	Windows User	Cell Change	Entire Lifecycle
	51	5/25/2017	1:14 PM	Windows User	Cell Change	Entire Lifecycle
	52	5/25/2017	1:14 PM	Windows User	Cell Change	Entire Lifecycle
	53	5/25/2017	1:24 PM	Windows User	Cell Change	Entire Lifecycle
	54	5/25/2017	1:24 PM	Windows User	Row Delete	Entire Lifecycle
	55	5/25/2017	1:24 PM	Windows User	Row Delete	Entire Lifecycle
	56	5/25/2017	1:24 PM	Windows User	Row Delete	Entire Lifecycle
	57	5/25/2017	1:24 PM	Windows User	Row Delete	Entire Lifecycle
	58	5/25/2017	2:43 PM	Doug	Cell Change	Entire Lifecycle

C117
C118
#REF!
#REF!

H3
I3

I63
I18
G23

F30

I33
G45
I18

G95

G134

I36
H71

H80
H71

I33
I114
'105:105
'55:55
'12:12
'3:3
H3

Provide a time estimate for sufficient LNAPL depletion of COCs by MNA
Provide details of post-EBR modeling to calculate time estimates for remediation
<blank>
<blank>

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
New MWs must have time to equilibrate after installation and development before baseline field data, geochemistry, and microbial analyses are performed.

Update based on additional field data
[I suspect that the range of variability in LNAPL mass calculations is so great that we won't be able to detect differences in estimated LNAPL mass from quarter
This would be a major effort, with multitudes of new boreholes, to map LNAPL in any more detail than we already have! Do we really need this?-DFP
New and existing MWs with recoverable NAPL, located in the area to be impacted by injections/ amendments, and downgradient of this area [Testing LNAPL that
Once
[Not sure what "once" means, but these geochemistry analyses should be done on every groundwater sample]
Reported on AF flowchart as Eh
[AF may convert field ORP values to Eh by correcting for the electrode potential of the reference electrode]
In an ideal world, it would be helpful to have these samplers placed so as to monitor the core of a plume (1-2 samplers), its periphery (1-2 samplers), and downgr

This would be a major effort, with multitudes of new boreholes, to map LNAPL in any more detail than we already have! Do we really need this? Or maybe you ju

Ideally, samplers would be deployed in the same MWs as for pre-EBR analysis. This way, we're comparing apples to apples, and have eliminated any variability due to different locations. Any thoughts, Dan?

Ideally, samplers would be deployed in the same MWs as for pre-EBR, and during-EBR analyses. This way, we're comparing apples to apples, and have eliminated any variability due to different locations. Any thoughts, Dan?

AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
[Probably means ferrous iron (i.e., dissolved iron), though it could be total iron (ferrous plus ferric), which is almost always mostly
Inhibition by other degradation processes and nutrient availability are not included in the model, are these factors important? How healthy are the indigenous r

Will periodic sulfate injections or recirculation be necessary to sustain degradation rates?
[I think AMEC is going toward multiple injections over time
Inhibition by other degradation processes and nutrient availability are not included in the model, are these factors important? How healthy are the indigenous r
Reported on AF flowchart as Eh
[AF converts field ORP values to Eh by correcting for the electrode potential of the reference electrode. In the Decision Tree they indicate: "(Correct to

[At the end of EBR, LNAPL should be sampled throughout the Site (not just from LNAPL in monitoring wells) to determine if LNAPL throughout the Site, including i

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u

Determine the time estimate for remaining LNAPL removal
Provide details of how post-EBR LNAPL models were generated
Calculate the amount of sulfate needed to complete benzene (dissolved and LNAPL) biodegradation
Provide details used to determine the sulfate calculations

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
New MWs must have time to equilabrate after installation and development before baseline field data, geochemistry, and microbial analyses are performed.

Update based on additional field data
<blank>
New and existing MWs with recoverable NAPL, located in the area to be impacted by injections/ amendments, and downgradient of this area

Once

Reported on AF flowchart as Eh
In an ideal world, it would be helpful to have these samplers placed so as to monitor the core of a plume (1-2 samplers), it's periphery (1-2 samplers), and downgı
This would be a major effort, with multitudes of new boreholes, to map LNAPL in any more detail than we already have! Do we really need this?-DFP

Ideally, samplers would be deployed in the same MWs as for pre-EBR analysis. This way, we're comparing apples to apples, and have eliminated any variability d

Ideally, samplers would be deployed in the same MWs as for pre-EBR, and during-EBR analyses. This way, we're comparing apples to apples, and have eliminatec

AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
Inhibition by other degradation processes and nutrient availability are not included in the model, are these factors important? How healthy are the indigenous n

Will periodic sulfate injections or recirculation be necessary to sustain degradation rates?
Inhibition by other degradation processes and nutrient availability are not included in the model, are these factors important? How healthy are the indigenous n
Reported on AF flowchart as Eh
[AF may convert field ORP values to Eh by correcting for the electrode potential of the reference electrode]
<blank>

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u

ısed for this evaluatior

radient (1 sampler). T

ue to different locatior

d any variability due to

nicrobial populations?

nicrobial populations?

ısed for this evaluatior

	59	5/25/2017	2:49 PM	Doug	Cell Change	Entire Lifecycle
	60	5/25/2017	2:50 PM	Doug	Cell Change	Entire Lifecycle
	61	5/25/2017	2:52 PM	Doug	Cell Change	Entire Lifecycle
	62	5/25/2017	2:56 PM	Doug	Cell Change	Entire Lifecycle
	63	5/25/2017	3:01 PM	Doug	Row Insert	Entire Lifecycle
	64	5/25/2017	3:01 PM	Doug	Cell Change	Entire Lifecycle
	65	5/25/2017	3:01 PM	Doug	Cell Change	Entire Lifecycle
	66	5/25/2017	3:01 PM	Doug	Cell Change	Entire Lifecycle
	67	5/25/2017	3:02 PM	Doug	Cell Change	Entire Lifecycle
	68	5/25/2017	3:02 PM	Doug	Cell Change	Entire Lifecycle
	69	5/25/2017	3:03 PM	Doug	Range Move	Entire Lifecycle
	70	5/25/2017	3:06 PM	Doug	Cell Change	Entire Lifecycle
	71	5/25/2017	3:09 PM	Doug	Cell Change	Entire Lifecycle
	72	5/25/2017	3:11 PM	Doug	Cell Change	Entire Lifecycle
	73	5/25/2017	3:14 PM	Doug	Cell Change	Entire Lifecycle
	74	5/25/2017	3:17 PM	Doug	Cell Change	Entire Lifecycle
	75	5/25/2017	3:17 PM	Doug	Cell Change	Entire Lifecycle
	76	5/25/2017	3:19 PM	Doug	Cell Change	Entire Lifecycle
	77	5/25/2017	3:22 PM	Doug	Cell Change	Entire Lifecycle
	78	5/25/2017	3:22 PM	Doug	Cell Change	Entire Lifecycle
	79	5/25/2017	3:27 PM	Doug	Cell Change	Entire Lifecycle
	80	5/25/2017	3:29 PM	Doug	Cell Change	Entire Lifecycle
	81	5/25/2017	3:37 PM	Doug	Cell Change	Entire Lifecycle
	82	5/25/2017	3:39 PM	Doug	Cell Change	Entire Lifecycle
	83	5/25/2017	3:51 PM	Doug	Cell Change	Entire Lifecycle
	84	5/25/2017	3:52 PM	Doug	Cell Change	Entire Lifecycle
	85	5/25/2017	3:53 PM	Doug	Cell Change	Entire Lifecycle
	86	5/25/2017	3:56 PM	Doug	Cell Change	Entire Lifecycle
	87	5/25/2017	3:58 PM	Doug	Cell Change	Entire Lifecycle
	88	5/25/2017	4:03 PM	Doug	Cell Change	Entire Lifecycle
	89	5/25/2017	4:03 PM	Doug	Cell Change	Entire Lifecycle
	90	5/25/2017	4:08 PM	Doug	Cell Change	Entire Lifecycle

H3

H3

H3

H3

'15:15

C15

F15

H15

C15

G15

I15, H15

I18

G23

C21

C24

G24

C24

I24

I24

H24

I26

I27

I27

I26

I63

I63

I64

I67

I68

F66

I66

E114

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
Perform Slug Tests in New Wells Once Hydraulic Conductivity Measurement
Perform Slug Tests All New Wells and Existing Wells that have not been tested
This would be a major effort, with multitudes of new boreholes, to map LNAPL in any more detail than we already have! Do we really need this? Or maybe you ju
New and existing MWs with recoverable NAPL, located in the area to be impacted by injections/ amendments, and downgradient of this area [Testing LNAPL that
Locate and map dissolved-phase TPH presence and concentration [Do we want TPH or SVOC analyses, whereby we could get more specific hydrocarbon concentr
Locate and map sulfate concentrations in the targeted treatment area as well as downgradient portions of the site
Targeted treatment area and downgradient portions of the site Locate and map sulfate concentrations
When compared to this baseline data, this information will help monitor for sulfate migration outside of the COC areas and facilitate comparison of EBR modeling
<blank>
When compared to this baseline data, this information will help monitor for sulfate migration outside of the COC areas and facilitate comparison of EBR modeling
EBR modeling by the AF ignored rate-limited mass transfer of hydrocarbons from the LNAPL to groundwater (AF modeling assumes equilibrium conditions betwe
Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results. EPA/ADEQ has sent a list of these deficiencies to
Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results. The Regulatory Agencies technical team has sent
EBR modeling by the AF ignored rate-limited mass transfer of hydrocarbons from the LNAPL to groundwater (AF modeling assumes equilibrium conditions betwe
Update based on additional field data [I suspect that the range of variability in LNAPL mass calculations is so great that we won't be able to detect differences in estimated LNAPL mass from quarter
Update based on additional field data [I suspect that the range of variability in LNAPL mass calculations is so great that we won't be able to detect differences in estimated LNAPL mass from quarter
Update based on additional field data [same comment as in above cell]
Ongoing updates as field data become available. EBR modeling by the AF ignored rate-limited mass transfer of hydrocarbons from the LNAPL to groundwater (AF
Ongoing updates as field data become available. Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results.
Quarterly [see my comment to the right --> Just do modeling post-EBR after all field data have been collected and use these modeling results (and, for example,
Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema
[Same comments as above]

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u
<blank>
<blank>
<blank>
Perform Slug Tests in New Wells
<blank>
This would be a major effort, with multitudes of new boreholes, to map LNAPL in any more detail than we already have! Do we really need this? Or maybe you ju
New and existing MWs with recoverable NAPL, located in the area to be impacted by injections/ amendments, and downgradient of this area [Testing LNAPL that
Locate and map dissolved-phase TPH presence and concentration
Locate and map sulfate concentrations in the targeted treatment area as well as downgradient
<blank>
Locate and map sulfate concentrations in the targeted treatment area as well as downgradient portions of the site
when compared to this baseline data, this information will help monitor for sulfate migration outside of the COC areas
When compared to this baseline data, this information will help monitor for sulfate migration outside of the COC areas and facilitate comparison of EBR modeling
<blank>
<blank>
Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results
Modeling to date by the AF has not been sufficiently documented to allow an independent check on the results. EPA/ADEQ has sent a list of these deficiencies to
EBR modeling by the AF ignored rate-limited mass transfer of hydrocarbons from the LNAPL to groundwater (AF modeling assumes equilibrium conditions betwe
Update based on additional field data
[I suspect that the range of variability in LNAPL mass calculations is so great that we won't be able to detect differences in estimated LNAPL mass from quarter
Update based on additional field data
[I suspect that the range of variability in LNAPL mass calculations is so great that we won't be able to detect differences in estimated LNAPL mass from quarter
Update based on additional field data
Ongoing updates as field data become available
Ongoing updates as field data become available
Quarterly
Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema
<blank>

ısed for this evaluatior
ısed for this evaluatior
ısed for this evaluatior
ısed for this evaluatior

st mean using LNAPL d
naturally moves into r

ş results with field data

AF.
en LNAPL and groundv

il dated 5/11)? benzer

	91	5/25/2017	4:08 PM	Doug	Cell Change	Entire Lifecycle
	92	5/25/2017	4:09 PM	Doug	Cell Change	Entire Lifecycle
	93	5/25/2017	4:14 PM	Doug	Cell Change	Entire Lifecycle
	94	5/25/2017	4:14 PM	Doug	Cell Change	Entire Lifecycle
	95	5/25/2017	4:14 PM	Doug	Cell Change	Entire Lifecycle
	96	5/25/2017	4:15 PM	Doug	Cell Change	Entire Lifecycle
	97	5/25/2017	4:15 PM	Doug	Cell Change	Entire Lifecycle
	98	5/25/2017	4:17 PM	Doug	Cell Change	Entire Lifecycle
	99	5/25/2017	3:37 PM	KBrasaemle	Cell Change	Entire Lifecycle
	100	5/30/2017	3:49 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	101	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	102	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	103	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	104	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	105	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	106	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	107	5/30/2017	5:09 PM	Workspaces_BYOL	Row Insert	Entire Lifecycle
	108	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	109	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	110	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	111	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	112	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	113	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	114	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	115	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	116	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	117	5/30/2017	5:09 PM	Workspaces_BYOL	Range Move	Entire Lifecycle
	118	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	119	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	120	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	121	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	122	5/30/2017	5:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	123	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
	124	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle

E118

I114

I116

E118

I116

I116

I118

F106

H3

F15

I3

I13

I15

B13

I17

C18

'19:19

I18

D18

C19

D19

D20

I20

C20

F20

G20

F21:G21, F20:G20

C21

C22

I22

D22

D23

G23

D26

[Same comments as above]

[At the end of EBR, LNAPL should be sampled throughout the Site (not just from LNAPL in monitoring wells) to determine if LNAPL throughout the Site, including i

Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema

[Same comments as above. Per my above comments, I don't think you need "modeling" during EBR, just post-EBR]

Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema

Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema

[Same comments as above]

Quarterly, until the official start of the MNA phase of the site (??) [What is the "official start of MNA"? Do you need data this often?]

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. The extraction wells can be used, but must be considered in

<blank>

New MWs must have time to equilibrate after installation and development before baseline field data, geochemistry, and microbial analyses are performed.
Data should be aquired for all three zones, including CZ
Data should be aquired for all three zones, including CZ
Hydrogeologic Data
See modeling comments by Bo
Continue to locate and map LNAPL presence and depth

Need to ensure good knowledge of locations where EBR treatments/amendments are being conducted, as well as downgradient
Y
Monitor benzene content and concentration in LNAPL, where LNAPL is found
Y
Y
Report (graph) dissolved-phase trends over time, in addition to LNAPL trends for perimeter wells
Continue to locate and map dissolved-phase benzene presence and concentration
Monthly
Perimeter wells

Continue to locate and map dissolved-phase SVOC presence and concentration
Calculate total LNAPL mass present at start of EBR
Done. ADEQ transmitted extensive comments on the most recent AF mass and composition estimates of remaining NAPL on May 16.
Y
<blank>

New and existing MWs with recoverable LNAPL
<blank>

<blank>

[At the end of EBR, LNAPL should be sampled throughout the Site (not just from LNAPL in monitoring wells) to determine if LNAPL throughout the Site, including i

Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema

[Same comments as above]

Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema

Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema

<blank>

Quarterly, until the official start of the MNA phase of the site (??)

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. Neither the injection wells nor the extraction wells can be u

Once

New MWs must have time to equilibrate after installation and development before baseline field data, geochemistry, and microbial analyses are performed.

<blank>

<blank>

Field Data

<blank>

Locate and map LNAPL presence and depth

This would be a major effort, with multitudes of new boreholes, to map LNAPL in any more detail than we already have! Do we really need this? Or maybe you ju

<blank>

<blank>

<blank>

<blank>

<blank>

Locate and map dissolved-phase benzene presence and concentration, in excess of 5 ug/L

<blank>

<blank>

Locate and map dissolved-phase TPH presence and concentration [Do we want TPH or SVOC analyses, whereby we could get more specific hydrocarbon concentr

Calculate total LNAPL mass is present at start of EBR

ADEQ transmitted extensive comments on the most recent AF mass and composition estimates of remaining NAPL on May 16.

Bo/Doug - has this been done to your satisfaction already?

Bo/Doug - has this been done to your satisfaction already?

New and existing MWs with recoverable NAPL, located in the area to be impacted by injections/ amendments, and downgradient of this area [Testing LNAPL that

Bo/Doug - has this been done to your satisfaction already?

n low permeability/lo
il dated 5/11)? benze

il dated 5/11)? benze
il dated 5/11)? benze

ısed for this evaluatio

st mean using LNAPL d

ation data that could b

naturally moves into

125	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
126	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
127	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
128	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
129	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
130	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
131	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
132	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
133	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
134	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
135	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
136	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
137	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
138	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
139	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
140	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
141	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
142	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
143	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
144	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
145	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
146	5/30/2017	5:58 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
147	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
148	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
149	5/30/2017	5:58 PM	Workspaces_BYOL	Row Insert	Entire Lifecycle
150	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
151	5/30/2017	5:58 PM	Workspaces_BYOL	Row Insert	Entire Lifecycle

D27
D28
D29
I25

F30

F25

F17

F13
H12

I33

I36
F45
G45
I60
F58
F57
F56
C61

I63
I64
I66
'71:71
F66
C67
'77:77
C77
'89:89

<blank>
<blank>
<blank>
<blank>
Once as baseline

Once as baseline

Once as baseline

Once as baseline

These data, collectively, will help establish baseline criteria against which project progress and goals can be compared. ***** ONE FINAL SYNOPTIC ROUND BEFC
Reported on AF flowchart as Eh

AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored

Once to establish baseline
SULFATE : Samplers placed so as to monitor the core of a plume (1-2 samplers), its periphery (1-2 samplers), and downgradient (1 sampler). These samplers ca
Need to ensure good knowledge of locations where EBR treatments/amendments are being conducted, as well as downgradient. Final Field Variance Memoran
annual??
quarterly
<blank>
Locate and map dissolved-phase benzene presence and concentration

<blank>
<blank>
<blank>

At least annual
Provide a time estimate for sufficient LNAPL depletion of COCs

Phosphorous

Bo/Doug - has this been done to your satisfaction already?
Bo/Doug - has this been done to your satisfaction already?
Bo/Doug - has this been done to your satisfaction already?
Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema
Once
[Not sure what "once" means, but these geochemistry analyses should be done on every groundwater sample]

Once

Once

Once
These data, collectively, will help establish baseline criteria against which project progress and goals can be compared.
Reported on AF flowchart as Eh
[AF converts field ORP values to Eh by correcting for the electrode potential of the reference electrode. In the Decision Tree they indicate: "(Correct to
AF decision flowchart only mentions "Iron" as an analyte, without differentiating which iron species will be monitored
[Probably means ferrous iron (i.e., dissolved iron), though it could be total iron (ferrous plus ferric), which is almost always mostly
<blank>
In an ideal world, it would be helpful to have these samplers placed so as to monitor the core of a plume (1-2 samplers), its periphery (1-2 samplers), and downgr
Final Field Variance Memorandum #5 – Extraction and Treatment System Construction, Former Liquid Fuels Storage Area, Site ST012, Former Williams Air Force B
<blank>
<blank>
Monthly for the first quarter of EBR, followed by quarterly
Locate and map dissolved-phase benzene presence and concentration, in excess of 5 ug/L
Update based on additional field data
[I suspect that the range of variability in LNAPL mass calculations is so great that we won't be able to detect differences in estimated LNAPL mass from quarter
Update based on additional field data [same comment as in above cell]
Bo/Doug: Want to comment on the use of proper transport mechanisms when doing modeling? What about half-saturation comments (Doug mentioned in ema

Quarterly [see my comment to the right --> Just do modeling post-EBR after all field data have been collected and use these modeling results (and, for example, r
Provide a time estimate for sufficient LNAPL depletion of COCs

<blank>

il dated 5/11)? benzer

adient (1 sampler). Tl
ase, Mesa, Arizona; 01

il dated 5/11)? benzer

neasured bio rates) as

152	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
153	5/30/2017	5:58 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
154	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
155	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
156	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
157	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
158	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
159	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
160	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
161	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
162	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
163	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
164	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
165	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
166	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
167	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
168	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
169	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
170	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
171	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
172	5/30/2017	6:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
173	5/31/2017	4:07 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
174	5/31/2017	4:07 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
175	5/31/2017	4:07 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
176	5/31/2017	4:07 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
177	5/31/2017	4:35 PM	Workspaces_BYOL	Row Insert	Entire Lifecycle
178	5/31/2017	4:35 PM	Workspaces_BYOL	Range Move Row(s)	Entire Lifecycle
179	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
180	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
181	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle

C89
I89

H80
G71
H71
#REF!
H9
I90

G95
F90
I95
F95

C94
I114
E114
F119
F116
F109

G134
E118
I118

B56
B106
H3
I3

'91:94
'105:105, 91:94
E87
#REF!
I87

Details of injection material
Proprietary??

Will periodic sulfate injections or recirculation be necessary to sustain degradation rates?

New and existing MWs
Inhibition by other degradation processes and nutrient availability are not included in the model, are these factors important? How healthy are the indigenous r
New wells pre-EBR
Do SVOC if find LNAPL (check Table 5.1 in case it's there)
is this back when full-strength concentration? Need to check Inj fluid before goes into ground to ensure concentration
due to different locations. Any thoughts, Dan?

Monthly, per Table 5.1 Need to check for each batch
This data will be used to determine how the indigenous microbial community has responded to the injections/amendments and if EBR is increasing benzene biod
At least once during EBR, 4-6 weeks after sulfate injection.

When sulfate is no longer limiting rates of degradation, what will limit the reaction and what degradation rates can be expected?
At the end of EBR, LNAPL should be sampled throughout the Site (not just from LNAPL in monitoring wells) to determine if LNAPL throughout the Site, including ir
[Same comments as above] ???
<blank>
<blank>
<blank>
eliminated any variability due to different locations. Any thoughts, Dan?

<blank>
<blank>

Hydrogeologic Data
Hydrogeologic Data
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. The extraction wells can be used, but must be considered in
MWs are needed in suitable locations to monitor the effectiveness of EBR. Otherwise, data evaluation will be much less meaningful. Accurate delineation of cor

During EBR, for every injection/ amendment event and location
<blank>
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016); This data will provide a record of exactly what was injected, where, and at what concentration. This

<blank>
<blank>

Will periodic sulfate injections or recirculation be necessary to sustain degradation rates?
[I think AMEC is going toward multiple injections over time
New and existing MWs, located in the area to be impacted by injections/ amendments, and downgradient of this area
Inhibition by other degradation processes and nutrient availability are not included in the model, are these factors important? How healthy are the indigenous n
<blank>
<blank>
<blank>
Ideally, samplers would be deployed in the same MWs as for pre-EBR analysis. This way, we're comparing apples to apples, and have eliminated any variability due to different locations. Any thoughts, Dan?
Monthly, per Table 5.1
This data will be used to determine how the indigenous microbial community has responded to the injections/amendments and if EBR is increasing benzene biod
At least once during EBR
When sulfate is no longer limiting rates of degradation, what will limit the reaction
and what degradation rates can be expected?
[At the end of EBR, LNAPL should be sampled throughout the Site (not just from LNAPL in monitoring wells) to determine if LNAPL throughout the Site, including i
[Same comments as above]
Quarterly, until the official start of the MNA phase of the site (??)
Quarterly, until the official start of the MNA phase of the site (??)
Quarterly, until the official start of the MNA phase of the site (??)
Ideally, samplers would be deployed in the same MWs as for pre-EBR, and during-EBR analyses. This way, we're comparing apples to apples, and have eliminated any variability due to different locations. Any thoughts, Dan?
[Same comments as above. Per my above comments, I don't think you need "modeling" during EBR, just post-EBR]
[Same comments as above]

Field Data
Field Data
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. The extraction wells can be used, but must be considered in
New MWs must have time to equilibrate after installation and development before baseline field data, geochemistry, and microbial analyses are performed.

<blank>
This data will provide a record of exactly what was injected, where, and at what concentration. This, when compared with the response by the contaminants and
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)

nicrobial populations?

egradation as intende

n low permeability/lo

separate groups and a

other geochemical an

182	5/31/2017	4:35 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
183	5/31/2017	4:35 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
184	5/31/2017	4:35 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
185	5/31/2017	4:35 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
186	5/31/2017	4:35 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
187	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
188	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
189	5/31/2017	4:35 PM	Workspaces_BYOL	Range Move	Entire Lifecycle
190	5/31/2017	4:35 PM	Workspaces_BYOL	Row Insert	Entire Lifecycle
191	5/31/2017	4:35 PM	Workspaces_BYOL	Range Move	Entire Lifecycle
192	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
193	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
194	5/31/2017	4:35 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
195	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
196	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
197	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
198	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
199	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
200	5/31/2017	4:53 PM	Workspaces_BYOL	Row Insert	Entire Lifecycle
201	5/31/2017	4:53 PM	Workspaces_BYOL	Range Move	Entire Lifecycle
202	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
203	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
204	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
205	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
206	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
207	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
208	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
209	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
210	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
211	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
212	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
213	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle

'105:105
'105:105
'105:105
'105:105
'105:105
#REF!
B3
B5, B3
'2:2
A3, B3
A2
H2
F3
H2

H3
I3
H12
I12
'7:11
C87:I87, C7:I11
E7
F7
G7
E8
F8
G8
E9
F9
G9
E10
F10
G10

<blank>
Monitoring Well Installations

Pre-Baseline
To prep for
(Once - is an installation)

These are additional wells to provide accurate monitoring of EBR
These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR.

The extraction wells can be used, but must be considered in separate groups and are not sufficient for this evaluation.
MWs are needed in suitable locations to monitor the effectiveness of EBR. Otherwise, data evaluation will be much less meaningful. Accurate delineation of cor
To provide one singular, synoptic round of data prior to inception of EBR
These data, collectively, will help establish baseline criteria against which project progress and goals can be compared and monitored.

During EBR, following Table 5.1
During EBR, following Table 5.1
Following Table 5.1
During EBR, following Table 5.1
During EBR, following Table 5.1
Following Table 5.2
During EBR, following Table 5.1
During EBR, following Table 5.1
Following Table 5.3
During EBR, following Table 5.1
During EBR, following Table 5.1
Following Table 5.4

Monitoring Well Installations
<blank>

<blank>
<blank>
(Installation)

To prep for

These MWs are needed to ensure that there are sufficient MWs to evaluate the effectiveness of EBR. The extraction wells can be used, but must be considered in
MWs are needed in suitable locations to monitor the effectiveness of EBR. Otherwise, data evaluation will be much less meaningful. Accurate delineation of cor
These data, collectively, will help establish baseline criteria against which project progress and goals can be compared. ***** ONE FINAL SYNOPTIC ROUND BEFC
<blank>

<blank>
<blank>
<blank>
<blank>
<blank>
<blank>
<blank>
<blank>
<blank>
<blank>
<blank>
<blank>

separate groups and a
ıcentrations in downgr
)RE EBR

214	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
215	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
216	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
217	5/31/2017	4:53 PM	Workspaces_BYOL	Range Move	Entire Lifecycle
218	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
219	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
220	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
221	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
222	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
223	5/31/2017	4:53 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
224	5/31/2017	4:53 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
225	5/31/2017	4:53 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
226	5/31/2017	4:53 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
227	5/31/2017	4:53 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
228	5/31/2017	4:53 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
229	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
230	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
231	5/31/2017	4:53 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
232	5/31/2017	4:57 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
233	5/31/2017	4:57 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
234	5/31/2017	4:57 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
235	5/31/2017	4:57 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
236	5/31/2017	4:57 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
237	5/31/2017	4:57 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
238	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
239	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
240	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
241	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle

E11
F11
G11
I9, H9
I7
I8
I9
I10
I11
'87:87
'87:87
'87:87
'87:87
'87:87
'87:87
I4
I5
I6

H9
C9
G8
G9
G10
G11

H11
I17
C21

G45

During EBR, following Table 5.1
During EBR, following Table 5.1
Following Table 5.5

Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)
Taken from Table 5.1, RD-RAWP Addendum 2 (March 2016)

7 treatment "ovals" proposed, but only 3 ovals have monitoring wells that are in reasonable locations (5/17 BCT slides) Karla: what was the reference for this? V
5 initial treatment "ovals" proposed; however, only one of the first 5 "ovals" where EBR is proposed for initial implementation has a monitoring well (ST012-UWE
15 treatment "ovals" proposed, but only 2 have monitoring wells in suitable locations. 3 additional "ovals" have monitoring wells located beyond the extraction

<blank>
LNAPL Dye Test; VOC and TPH if Dye Test is Positive
Following Table 5.1
Following Table 5.1
Following Table 5.1
Following Table 5.1

To determine if benzene is slower to degrade than other aromatics (or faster, or average)
See modeling comments by Bo Stewart, 5/17
Continue to locate and map dissolved-phase SVOC presence and concentration Do we need to re-phrase??
Samplers should be placed so as to monitor the core of sulfate injections, its periphery, and downgradient.

All three zones should be monitored.

The same wells should be monitored pre-EBR, during EBR, and post-EBR.

<blank>
<blank>
<blank>

<blank>
<blank>
<blank>
<blank>
<blank>

7 treatment “ovals” proposed, but only 3 ovals have monitoring wells that are in reasonable locations (5/17 BCT slides)
5 initial treatment “ovals” proposed; however, only one of the first 5 “ovals” where EBR is proposed for initial implementation has a monitoring well (ST012-UWB
15 treatment “ovals” proposed, but only 2 have monitoring wells in suitable locations. 3 additional “ovals” have monitoring wells located beyond the extraction

Do SVOC if find LNAPL (check Table 5.1 in case it's there)
LNAPL Dye Test
Following Table 5.2
Following Table 5.3
Following Table 5.4
Following Table 5.5

Is benzene slower to degrade than other aromatics, or faster, or average?
See modeling comments by Bo
Continue to locate and map dissolved-phase SVOC presence and concentration

SULFATE : Samplers placed so as to monitor the core of a plume (1-2 samplers), its periphery (1-2 samplers), and downgradient (1 sampler). These samplers ca

iZ24), but it is not locat
well. Depending on hc

innot be used in LNAPI

242	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
243	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
244	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
245	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
246	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
247	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
248	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
249	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
250	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
251	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
252	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
253	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
254	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
255	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
256	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
257	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
258	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
259	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
260	5/31/2017	5:47 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle

I45
H45

G95
H95

I95

G134
H134

I134
H71
H77
H78
H79
H81

H80
C89
I89
F90
I90
F95

All items other than the last metric are included as part of the already-proposed standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision
These analyses will quantify the size, makeup, and health of the indigenous microbial community.
Samplers should be placed so as to monitor the core of sulfate injections, its periphery, and downgradient.

All three zones should be monitored.

The same wells should be monitored pre-EBR, during EBR, and post-EBR.
These analyses will quantify the size, makeup, and health of the indigenous microbial community.

All items other than the last metric are included as part of the already-proposed standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision
Samplers should be placed so as to monitor the core of sulfate injections, its periphery, and downgradient.

All three zones should be monitored.

The same wells should be monitored pre-EBR, during EBR, and post-EBR.
These analyses will quantify the size, makeup, and health of the indigenous microbial community.

All items other than the last metric are included as part of the already-proposed standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision
<blank>
To help monitor key microbial nutrient availability
Will help determine preferer TEA for indigenous microbes
Will help determine preferer TEA for indigenous microbes
To monitor if hydrogen sulfide concentrations inhibit degradation or will subsurface conditions mitigate their buildup?

To monitor if periodic sulfate injections or recirculation be necessary to sustain degradation rates
Details of injection material composition
This may be proprietary, however, an effort to obtain this information should be made
Monthly, per Table 5.1 Need to check each batch
Need to check the injection fluid before goes into ground to ensure concentration is as expected , was mixed and diluted correctly, etc.
At least once during EBR, 4-6 weeks after initial sulfate injection. May need to be repeated if geochem data suggests a problem.

These analyses will quantify the size, makeup, and health of the indigenous microbial community. All items other than the last metric are included as part of the
<blank>

Ideally, samplers would be deployed in the same MWs as for pre-EBR analysis. This way, we're comparing apples to apples, and have eliminated any variability due to different locations. Any thoughts, Dan?

<blank>

This data will be used to determine how the indigenous microbial community has responded to the injections/amendments and if EBR is increasing benzene biod

Ideally, samplers would be deployed in the same MWs as for pre-EBR, and during-EBR analyses. This way, we're comparing apples to apples, and have eliminated any variability due to different locations. Any thoughts, Dan?

<blank>

This data will be used to determine how the indigenous microbial community has responded to the injections/amendments and if EBR is increasing benzene biod
Inhibition by other degradation processes and nutrient availability are not included in the model, are these factors important? How healthy are the indigenous n
<blank>
<blank>
<blank>
Will hydrogen sulfide concentrations inhibit degradation or will subsurface conditions mitigate their buildup?
Will periodic sulfate injections or recirculation be necessary to sustain degradation rates?

Details of injection material
Proprietary??
Monthly, per Table 5.1 Need to check for each batch
is this back when full-strength concentration? Need to check Inj fluid before goes into ground to ensure concentration
At least once during EBR, 4-6 weeks after sulfate injection.

already-proposed stan

egradation as intende

egradation as intende
nicrobial populations?

261	5/31/2017	6:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
262	5/31/2017	6:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
263	5/31/2017	6:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
264	5/31/2017	6:09 PM	Workspaces_BYOL	Cell Change	Entire Lifecycle
265	5/31/2017	6:09 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle
266	5/31/2017	6:09 PM	Workspaces_BYOL	Row Delete	Entire Lifecycle

The history ends with the changes saved on 5/31/2017 at 6:09 PM.

H95
H98

I95
H134
'119:119
'119:119

These analyses will quantify the size, makeup, and health of the indigenous microbial community.

If there are indications that the microbial population is struggling during EBR, the analyses should be repeated to determine if alternate strategies are nee
May also help determine lag time for SRBs to acclimate to elevated sulfate concentrations and determine if highly concentrated injections of sulfate will be inhibi

All items other than the last metric are included as part of the already-proposed, standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision
These analyses will quantify the size, makeup, and health of the indigenous microbial community at the end of EBR, and will provide baseline data for MNA

These analyses will quantify the size, makeup, and health of the indigenous microbial community.
What is the lag time for SRB to acclimate to elevated sulfate concentrations (not included in the model)? Determine if highly concentrated injections of sulfate w

All items other than the last metric are included as part of the already-proposed standard stable-isotope probe (SIP; Bio-Trap) study listed on the AF decision
These analyses will quantify the size, makeup, and health of the indigenous microbial community.

---

ill be inhibitive to bact